

# Perturbations to the Chemocline of the Ocean During the End-Permian Mass Extinction

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The latest Permian is a time of major change in ocean chemistry, as well experiencing the greatest mass extinction of the Phanerozoic. The causes of these changes remains a subject of intense research and many current theories invoke changes to the oceanic sulfur cycle. Carbonate associated sulfate (CAS) has the potential to provide a high resolution record of variations in the concentration and stable isotopic composition of seawater sulfate. The majority of current data derive from evaporites or pyrites, both of which are relatively rare in the stratigraphic record. Our research focuses on the marine CAS record, and we have obtained samples from two sections that span the Permian-Triassic boundary (PTB); the Meishan and Shangsi sections located in Southern China. Isotopic analysis of the CAS provides a detailed record of several isotopic shifts in  $\delta^{34}\text{S}$  approaching and across the PTB. Values for  $\delta^{34}\text{S}$  range from 30‰ to -15‰ (VCDT) reversing several times across the sections. The  $\Delta^{13}\text{C}$  ( $\delta^{13}\text{C}_{\text{carb}} - \delta^{13}\text{C}_{\text{org}}$ ) in the samples increase to the event and sharply decrease across the event horizon, potentially indicating a buildup and decline of  $\text{CO}_2$ . We interpret the patterns of isotopic shifts to indicate an unstable chemocline overlying euxinic deep water which periodically upwells into the photic zone. The introduction of sulfide damaged the shelf ecosystem and altered the isotopic composition of the surface water sulfate. The sulfidic intrusions occurred several times during the end-Permian. A large sulfide release occurred during the major extinction interval, and subsequent releases occurred during the earliest Triassic.